Conservation Strategy

for

Calochortus umpquaensis

Umpqua Mariposa Lily

U. S. Department of Interior
Bureau of Land Management
Roseburg and Medford Districts

U. S. Department of Agriculture
National Forest Service
Umpqua National Forest

1995

Conservation Strategy Approval

The Mt Scott and South Douglas Resource Areas of the Roseburg District BLM, the Butte Falls and Grants Pass Resource Area of the Medford BLM, and the Tiller Ranger District of the Umpqua National Forest agree to implement the Conservation Strategy for *Calochortus umpquaensis* as available funding permits.

12-15-95
District Manager, Roseburg BLM — Date

12-8-95
Area Manager, Mt Scott Resource Area, Roseburg BLM — Date

12-8-95
Area Manager, South Douglas Resource Area, Roseburg BLM — Date

2-1-96
District Manager, Medford BLM — Date

2-1-96
Area Manager, Butte Falls Resource Area, Medford BLM — Date

2-1-96
Area Manager, Grants Pass Resource Area, Medford BLM — Date

1.9.96
Forest Supervisor, Umpqua National Forest — Date

1/9/95
District Ranger, Tiller Ranger District, Umpqua National Forest — Date

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Introduction

Calochortus umpquaensis (Umpqua mariposa lily) is a southwest Oregon endemic restricted to serpentine soils in southern Douglas County and northern Josephine and Jackson Counties (Fredricks 1989a). It is listed as endangered by the State of Oregon. The U.S. Fish and Wildlife Service has determined it to be biologically appropriate for listing as threatened or endangered and has included it in its list of Federal Candidate Category 1 species (FR 58:51144-51189).

Virtually all potential habitat has been surveyed for C. *umpquaensis* (Kagan 1992). Five populations have been identified, two of which consist of multiple subpopulations. Populations occur on land managed by the Umpqua National Forest and the Medford and Roseburg Districts of the Bureau of Land Management as well as land owned by private individuals, timber companies, and Douglas County. Populations are isolated from one another providing little or no opportunity for genetic exchange. Threats include ecological succession, predation by deer and insects, logging, grazing, exotic grasses, mining, residential development, and bulb collection.

The purpose of this conservation strategy is to identify and schedule management actions that will remove or limit threats to C. *umpquaensis* and provide for its long term survival. The strategy is a companion document to the conservation agreement with the U.S. Fish & Wildlife Service. Successful implementation will require the cooperation of the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish Wildlife Service.

The life of this strategy will be ten years after which time the status of C. *umpquaensis* along with the objectives and methods included in the strategy will be re-evaluated.

Biological Information

Species Description

Calochortus umpquaensis is a distinct, showy perennial forb in the lily family that blooms late May to early June (Figure 1). A technical description of the species is provided in Fredricks (1989b). The following general description was taken from Fredricks (1989a).

> Umpqua mariposa lily is a bulbous perennial herb with a single basal leaf 8 to 12 inches long and a flowering stalk 8 to 20 inches high, bearing 1 to 5 flowers. The leaf is dark green and smooth on one side, with parallel rows of fine hairs on the other. The three-petaled, white flowers are 1.5 to 3 inches in diameter. The base of the petal, or claw, is green, with a band of branched, white hairs immediately above it. This area is referred to as the "gland" in technical keys to members of the genus and is best studied with the aid of a hand lens. Above the gland is a deep purple petal spot which varies in size and shading, grading to violet in some populations. Rarely, the petal spot may be absent. The capsules are pendent and range from 1 to 2 inches long at maturity. The seeds are oblong and light yellow to tan.

There are three other species of Calochortus that occur with in the range of C. *umpquaensis* with which C. *umpquaensis* may be confused, C. *coxii, C. howellii,* and C. *tolmiei. Calochortus tolmiei* is a widespread species and the only one of the four that occurs sympatrically with C. *umpquaensis.* The other two species are southwestern Oregon, serpentine endemics which have never been found growing together or with C. *umpquaensis.*

Calochortus tolmiei can be most easily distinguished vegetatively from C. *umpquaensis* by its glabrous and glaucous leaves. *Calochortus umpquaensis* (as well as C. *coxii* and C. *howellii)* has pubescence in parallel rows along the underside of its leaves. The flowers of C. *umpguaensis* are relatively large with spreading petals as opposed to C. *tolmiei* that has smaller cup shaped flowers. C. *tolmiei* blooms three to four weeks before C. *umpquaensis.*

Calochortus howellii is most easily distinguished from C. *umpquaensis* by relatively small erect capsules. In flower, C. *howellii* differs by the absence of a basal purple spot and the presence of purple hairs above the gland. C. *howellii* blooms about two weeks after C. *umpquaensis.*

Calochortus coxii is distinguished from C. *umpquaensis* by flowers that have erect petals with pink striations at their bases and a dense yellow pubescence above the gland. C. *coxii* blooms two to three weeks after C. *umpquaensis.*

Range and Distribution

Calochortus umpquaensis is restricted to serpentine habitats in southwestern Oregon from southern Douglas County to northern Jackson and Josephine Counties (Appendix A). Five population areas have been located, two of which consist of multiple subpopulations. All sites are located in the remnants of a serpentine belt along the western margin of the West

Slope of the Cascade physiographic province as described by Franklin and Dyrness (1973). Populations are isolated from one another with little opportunity for genetic exchange. Occupied habitat totals less than 2000 acres. Numbers of individuals found in the five populations range from as few as 50 at Sexton Mountain in Josephine County to many thousands in the Little River drainage of Douglas County.

Habitat Description

Calochortus umpquaensis is found in a number of different habitats ranging from woodlands to open grasslands. It appears to favor open grasslands dominated by native bunch grasses and the ecotone between the grasslands and woodlands (Kagan 1992, Fredricks 1989a). Within these habitats, there is a fair amount of diversity in plant associations, soils, aspects and slopes.

Plant Associations. The forested communities in which Calochortus umpquaensis is found are dominated by *Pinus jeffreyi, Pseudotsuga menziesii,* and *Calocedrus cfecurrens.* They occur in areas with a diverse, but usually open understory. Shrubs include poison oak (Rhus diversiloba), buckbrush *(Ceanothus cuneatus)* and sticky manzanita *(Arctostaphylos viscida).* The understory is usually dominated by grasses, with shade tolerant grasses such as *Festuca californica, Koeieria cristata, Eiymus giaucus, Bromus carinatus* and *Melica subulata* or with *Festuca idahoensis, Danthonia californica,* and *Stipa lemmonii* in more open areas.

The meadows are largely a mix of natural, serpentine bunchgrasses dominated by *Festuca idahoends, Danthonia caiifornica,* and *Stipa iemmonii,* and introduced annual weedy grasses such as *Bromus mollis Cynosurus echinatus,* and *Aira caryophyiiea.* When found in the meadows, *Calochortus umpquaensis* usually occurs in patches associated with the native bunchgrasses.

A complete list of associate species that occur throughout the range of C. umpquaensis is provided in Appendix B.

Soils. Calochortus umpquaensis is endemic to serpentine-derived soil. All populations of the species fall within ultramaphic inclusions mapped by Wells and Peck (1961). Soil analyses support their serpentine derivation. They have low levels of macronutrients potassium and phosphorus, have a low calcium/magnesium ratio, and have above average concentrations of nickel, chromium, cobalt, and zinc. The surface soil ranges in pH from 6.0 to 7.0 with an average of 6.5 (n=4). Subsurface soil pH at depth of approximately five inches averaged 7.0 (n=4) and ranged from 6.85 to 7.1 (Fredricks, 1986).

The majority of the *Calochortus umpquaensis* sites fall within the Pearsoll gravelly clay loam-Cornutt gravelly clay loam association (BLM 1977). Pearsoll and Cornutt soils occur together in a random fashion, with Pearsoll more prevalent on steeper slopes. Inclusions of deep black, sometimes poorly drained, serpentinitic soils comprise approximately 10 percent of both mapping units.

The Pearsoll series consists of shallow, reddish brown, very gravelly, xeric soils derived from ultramaphic rocks which are mostly serpentine. A gravelly clay loam topsoil and a gravelly

silty clay subsoil characterized these soils, with depth to bedrock ranging from 12 to 20 inches.

The similar Cornutt series consists of moderately deep, red, gravelly clay, xeric soils also derived from typically serpentinitic ultramaphic rocks. Topsoils are similar to Pearsoll. Subsoil is a gravelly clay. Depth to bedrock ranges from 20 to 40 inches.

According to the BLM Soil Inventory (BLM 1977), Pearsoll and Cornutt soils support few trees. As suggested by the sparseness of overstory vegetation, these soils have very low productivity. The most common factors cited for poor growth on serpentine soils include poor structure and physical characteristics, which affects water-holding capacity; low levels of available molybdenum, soil micro-organisms, and macronutrients including nitrogen, phosphorus, and potassium; and high levels of nickel, chromium, iron, and magnesium.

Aspect and Slope. Aspect appears to vary for Calochortus umpquaensis over its range, with plants found on all aspects, including south facing slopes at the northern most population in the Little River drainage, but tending towards north and east facing slopes in the more southerly populations. Slopes range from 0 to 65%.

Population Descriptions

Virtually all potential habitat for C. umpquaensis has been surveyed (Kagan 1992). Five populations have been identified two of which consist of multiple subpopulations. Populations occur on land managed by the Umpqua National Forest and the Medford and Roseburg Districts of the Bureau of Land Management as well as land owned by private individuals, timber companies, and Douglas County. Populations are isolated from one another with little or no opportunity for genetic exchange. A summary of population data is provided in Appendix C.

1. Little River Population. This population is composed of four subpopulations. These subpopulations are among the largest and contain some of the most viable habitat known throughout the range of the species. Little River is the most diverse population with plants occurring on all aspects and with the greatest range in elevation and.habitat conditions.

A. Ace Williams Mountain Subpopulation.

This subpopulation supports a large number of plants but is located mostly on private land. The subpopulation occurs across approximately 250 acres of land 34 of which are managed by the BLM. Within this acreage there is significant amount of unoccupied suitable habitat. Recent monitoring studies indicate there are approximately 600,000 plants present on BLM land. Most plants are found on west to southwest facing slopes in forest, grassland, and ecotone habitats. Elevation ranges between 800 and 2000 feet. Private holdings have been grazed, logged, and developed for rural housing.

B. Standley Road Subpopulation.

This population is located entirely on private land developed for rural residential housing. It is approximately 75 acres in size and supports between 1000 and 10,000 plants. Aspect is mostly northeast and most plants are found in grassland and open forest habitats. Elevation ranges between 800 and 1200 feet. This subpopulation has been severely impacted by quarry development, maintenance of a 500 KV powerline, grazing, and rural residential development.

C. Jim Creek Subpopulation.

This subpopulation consists of three moderate sized patches located on both private and BLM land. Size is estimated at approximately 25 acres, two of which are privately owned. Numbers of plants are estimated to range between 1000 and 5000. Most plants are found in grasslands and open woods, Logging followed by development of a Douglas-fir plantation has eliminated some habitat at this location. Isolated plants can still be found in openings in the young Douglas-fir plantation and in open grassy patches along old roads. Aspect across the subpopulation varies northeast to southeast and elevation ranges between 1300 and 2000 feet. Logging is a potential threat on private land.

D. Watson Mountain Subpopulation.

This is a fairly stable and continuous patch of 100 to 1000 plants located on private land. The subpopulation is now limited to only eight acres and is clearly the remnant of what was once a much larger population which extended down to Little River and connected with what is now the Standley Road and Jim Creek subpopulations. Plants occur on open ridges and east facing slopes between 2000 and 2300 feet elevation. Soils are very shallow indicating there is little danger of forest succession threatening the population in the near future, The site has been grazed in the past.

2. North Mvrtle Creek Population. This population has relatively few individuals scattered intermittently over 91 acres. The BLM manages 66 of these acres. The remaining 25 acres are privately owned. Numbers of plants are estimated to be less than 1000. Habitat varies between grassland, open woodlands, and Ceanothus cuneafus chaparral on northeast aspects between 1600 and 2700 feet elevation. Plants in this population are unique in that they have yellow hairs in the flowers. No other population throughout the range of the species has this floral characteristic. Kagan (1992) speculates that there may have been genetic exchange between C. umpquaensis and C. coxii at this location. Impacts have occurred from logging, road construction, and quarry development.

3. Callahan Creek Population. Callahan Creek is a large complex population consisting of three subpopulations. One subpopulation occurs on a combination of BLM, Forest Service and private land. The other two occur on a mix of Forest Service and private land.

A. Elk Creek Subpopulation.

This subpopulation of approximately 130 plants consists of three patches along the east side of Elk Creek on roughly six acres of BLM, Forest Service and private land. Habitat consists of open woodland and *Ceanothus cuneatus* chaparral. Slopes are

steep with a west aspect. Elevation ranges between 1100 and 1300 feet. Portions of the subpopulation is located within a powerline right-of-way.

B. Drew Creek Subpopulation.

This is the largest subpopulation in the Callahan Creek complex with an estimated 70,000 plants extending across approximately 800 acres of Forest Service and private lands on both sides of Drew Creek. Portions of the habitat are in excellent condition and support the best example known of a low elevation serpentine forest in the West Slope of the Oregon Cascade Physiographic Province. Habitat varies between woodland, Savannah, and meadow. Elevation ranges between 1500 and 2600 feet. Aspect varies northerly between east and west. Secondary succession appears to be decreasing the available habitat on the north facing slopes. Exotic grasses introduced as a result of past grazing may be inhibiting the re-establishment of C. umpquaensis at certain locations in the subpopulation. Some of the habitat has been logged.

C. Callahan Ridge Subpopulation.

This subpopulation is located on approximately 100 acres of Forest Service and privately owned land along the ridge and east southeast facing slopes of Callahan Ridge. Densest concentrations of plants occur in native bunchgrass grasslands. Lesser concentrations occur in adjacent woodlands, grasslands dominated by annual grasses, and chaparral. Plants tend to ring the large, open serpentine grassland on the east-southeast facing slopes of Callahan ridge. Over grazing and competition from annual grasses in the meadow and secondary succession in the adjacent woodlands may have caused this distribution pattern and resulted in population declines. There are two disjunct patches of plants associated with this subpopulation. One is located on Forest Service land at the north end of the private inholding. The other is composed of only two plants and is located east of the main subpopulation. Neither site is likely to remain viable over time. Preliminary sampling indicate in excess of 10,000 plants for the subpopulation as a whole. Elevation ranges between 2300 and 2700 feet.

4. Sexton Mountain Population

This is a small population of less than 100 plants distributed across 10 acres of BLM land on a north facing slope of Sexton Mountain. Plants are restricted to open grasslands dominated by *Festuca idahoensis.* Habitat is in good condition with little evidence of disturbance. Secondary succession does not appear to be threatening the population. There is a dirt road along the ridge above the population and disturbance on the south slope on the opposite side of the ridge which may have reduced the size of the population in the past. Elevation ranges between 2400 and 2600 feet.

5. Sprionet Butte

This is another small population of less than 100 plants located on approximately five acres of BLM land on an east facing slope just below the ridge of Sprignet Butte. The habitat is dominated by jeffrey pine and incense cedar. The population is in good condition though

there has been high rates of herbivory by native wildlife. Secondary succession does not appear to be threatening the population. Elevation ranges between 2700 and 2900 feet. There is additional suitable habitat in the area that has not been surveyed where more C. umpquaensis may be found.

Pooulation Biolonv

Leaves of *Calochortus umpquaensis* emerge in early spring. Plants bloom between late May and mid July depending on elevation and annual fluctuations in climate. Time from flower to seed set is approximately one month (Fredricks 1989a). Reproductive success appears'to vary with habitat (Fredricks 1989a; BLM 1991, 1992). Plants in meadow and ecotone habitats produce a greater proportion of capsules (typically 510%) as do plants in forest habitats (typically less than 1%).

Reproduction in *Calochortus umpquaensis* is entirely sexual. Vegetative reproduction is not known to occur. Although no definitive studies have been made, *Calochortus umpquaensis* may be self-incompatible, as is the related species C. *howellii* (Fredricks 1986). *Calochortus umpquaensis* is suspected to be insect pollinated, probably by bees and/or beetles.

The high germination rates for *Calochortus umpguaensis* seeds (95 to 100 percent during laboratory trials) suggests that a dormant seed bank does not exist, or is insignificant. Seeds were found to require 8 to 12 weeks at 5 degrees C for germination (Fredricks 1986).

Monitoring studies have shown that the age distribution for *Calochortus umpquaensis* is generally bell-shaped with relatively few individuals in the smaller age classes (Fredricks 1989a; BLM 1991, 1992). Fewer individuals in the smaller age classes indicates that recruitment is low and suggests that *Calochortus umpquaensis* may not be able to recolonize quickly after a disturbance event. This type of age distribution has been documented in several other species of Calochortus found in Oregon and may not be unusual for the genus (Fredricks 1989a; BLM 1991, 1992). More research is necessary to determine what may be limiting germination or causing high seedling mortality.

Threats

Herbivory. Native wildlife and insect predation of the buds, flowers, and capsules causes significant impact on seed production. Grazing by black-tailed deer and rabbits may result in near total loss of capsules from certain areas. Monitoring studies (Fredricks 1989a, BLM 1991, 1992) have shown that as many as 83% of the plants that have produced buds have been grazed before they produced capsules and disseminated seeds. Similar impacts resulting from herbivory have been documented for *Calochortus greenei (Brock* 1988, Knight 1992). This degree of predation reduces seedling recruitment and could adversely affect population structure if grazing pressure remains high over several consecutive years. High predation has been observed in all of the populations and may be a limiting factor.

Succession and Fire Suppression. *Calochortus umpquaensis* occurs in an area with a very high natural fire frequency, due to hot, dry summers and an abundance of lightning. In

addition, it is quite possible that native people prior to European settlement used prescribed fires to maintain a more open habitat. Fire suppression since pioneer settlement has drastically altered much of the habitat for Calochortus *umpguaensis* Many of the sites for this species occur on north, east, and northwest facing slopes in conifer woodlands which have become closed canopy forests over the last 100 years.

Evidence indicates that prior to pioneer settlement, much of C. *umpquaensis* habitat was open forest dominated by Jeffrey pine with occasional incense cedars and Douglas firs and a limited shrub layer maintained by a fire frequency of 10 to 20 years (Kagan 1992). Without the presence of exotic annual grasses the understory would have been dominated by the native bunchgrasses Idaho fescue and California oatgrass.

As a result of fire suppression, these open woodlands are becoming closed canopy Douglas fir forests, which provide minimal if any habitat for *Calochortus umpquaensis.* Reintroduction of natural or prescribed fires into its habitat is likely to be very difficult, as a result of the increase of rural developments in the area, the significance of the local timber industry, and the potential difficulty of fire control in the rugged terrain. However, without some reintroduction of fire, the largest populations of this species on public lands may continue to decline or may disappear over time.

Logging. A number of populations have been impacted by logging practices which have resulted in major soil disturbance and the replanting of dense, closed canopy forests. Selective logging has served to increase habitat in the Callahan Ridge population by reducing the effect of recent fire suppression activities which are changing the nature of many of the populations of *Calochortus umpquaensis* (Kagan 1990).

Logging is a serious threat for this species if the timber harvest activities destroy plants or result in extensive soil disturbance, or if it is followed by the development of dense plantations which rapidly lead to a closed canopy forest. Logging can be used as a management tool if these practices are avoided.

Grazing. Much of the habitat shows evidence of past or present livestock grazing, by cattle or sheep. Evidence suggests that livestock grazing may place populations of *Calochorfus umpquaensis* at risk. Studies have shown that *Calochortus* individuals are adversely affected by the removal of leaves by grazing (Fredricks 1989a). Removal of leaves causes a depletion of carbohydrate reserves and results in reduction in size and reproduction in the years following grazing. Like many bulbous perennials, *Calochortus umpquaensis* is apparently slow growing, so re-establishment may take decades and stabilization of the population structure may be slow (Fredricks et al. 1992).

Exotic Grass Invasion. All of the occurrences of *Calochortus umpquaensis* have a notable presence of non-native annual grasses (e.g. *Aira caryophyllea, Bromus* spp., *Vulpia* spp., and *Cynosurus echinatus).* The meadows, in particular, have witnessed what appears to be a conversion from a native bunchgrass, or other grass-forb community, to annual grass dominated communities. Annual grasses can germinate and develop root systems over a wide range of temperature and moisture conditions making them highly competitive with seedlings of native perennials such as *Calochortus umpquaensis* (Dobrowolski et al. 1990). The influx of annual grasses into a community can also alter biophysical processes such as

fire-return intervals and intensity and nutrient cycling (Agee 1993). Restoration of the BLM annual grasslands located at the Little River population and the Forest Service annual grasslands at Callahan Meadows could increase the habitat available for this species.

Mining. All of the sites for Calochortus *umpquaensis* occur on serpentine lands. Though no mining has been observed at any of the populations, serpentine soils are noted for their mineral potential. Mining has become a serious threat for other serpentine endemic species and should be considered a threat for C. *umpquaensis* as well.

Residential Development. The Little River population is the only population where residential development is a significant threat. Each of the Little River subpopulations is at least partially located on privately owned land that has already been developed or has the potential for residential development. The entire Standley Road subpopulation is located in a housing development which has been subdivided into 5 to 10 acre lots. All of the Ace Williams Mountain subpopulation has been subdivided into small ranchettes with single family homes except for 35 acres of BLM land. The Watson Mountain and portions of the Jim Creek subpopulation are located on parcels of land owned by single individuals though no homes have been constructed to date. Further subdivision and development is expected throughout the Little River population. Residential development results in the destruction of habitat from the construction of homes and out buildings and impacts habitat on adjacent federal land from increased recreation,

Utilitv Rioht-of-Ways. A PP&L powerline right-of-way transects the Little River and Callahan Creek populations. Activities such as line maintenance, pole replacement, and vegetation control have a potential of impacting the C. *umpquaensis* that occurs within these right-of-ways. Development of new utility lines (i.e. fiber optic lines) either in or out of these existing utility right-of-ways is an additional threat.

Bulb Collecting. It has been well documented that bulbs of *Calochortus* have been extensively collected in the past. In the late 1800's one individual was reported to have collected over a quarter of a million *Calochortus* bulbs in one year (Fredricks 1989a). Demand for wild bulbs still exists. Farwig and Girard (1981) reported one individual who had been recently found collecting *Calochortus* bulbs to fill a contract with a foreign nursery for 10,000 bulbs and there have been undocumented reports of *Calochortus umpquaensis* bulbs being collected from the Little River and Callahan Ridge populations for horticultural purposes.

Proposed Management Actions

Management Objective

The objective of the management actions proposed in this conservation strategy is to maintain or increase the numbers of Calochortus umpquaensis by maintaining and restoring habitat in each of the five populations so as to remove the need to list it as threatened or endangered.

Proposed Management Actions bv Population

An implementation schedule for all of the management actions proposed for each population is provided in Appendix D.

1. Little River Population (four separate subpopulations)

   A. Ace Williams Mountain Subpopulation

Most of the habitat of this subpopulation (all but 34 acres) is privately owned. The private land has been divided into several parcels. One parcel is owned by Seneca Timber Company. Threats include herbivory, natural succession resulting from fire suppression, logging, grazing, and residential development.

- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Coordinate with PP&L to mitigate impacts from pole, tower, and right-of-way maintenance.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Install gates and fences to manage access to livestock and vehicles.
- Manage livestock grazing inside habitat boundaries.
- Develop burn plan and prescribe burn habitat on public land every 10 to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.
- Develop habitat restoration plan and restore meadow habitat with native bunch grasses or other native species, as appropriate.
- Monitor plants on public land to determine population trends and effects of management treatments.

B. Standley Road Subpopulation

This subpopulation occurs entirely on private land which has been subdivided into 5 to 10 acre parcels and developed for rural residential housing. Threats include residential development, natural succession, and grazing.

- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Coordinate with PP&L to mitigate impacts from pole, tower, and right-of-way maintenance.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.

C. Jim Creek Subpopulation

This subpopulation occurs mostly on BLM land. Two acres out of a total of 25 are privately owned. The private land is owned by Roseburg Forest Products. Threats include natural succession, logging, and grazing.

- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Install gates and fences to manage access by livestock and vehicles.
- Manage livestock grazing inside habit boundaries.
- Develop burn plan and prescribe burn habitat on public land every 10 to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.
- Develop habitat restoration plan and restore meadow habitat with native bunch grasses or other native species, as appropriate.
- Monitor plants on public land to determine population trends and effects of management treatments.

D. Watson Mountain Subpopulation.

This eight acre subpopulation occurs entirely on private land owned by one individual. Threats include herbivory, natural succession, logging, and grazing.

- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.

2. North Myrtle Creek Population

This population is located on 66 acres of BLM land and 25 acres of private land. Ownership of the private land is divided between Douglas County and Champion International. Threats include herbivory, natural succession, logging, and mining (saleable minerals). Habitat satisfies the Douglas-fir, Jeffrey pine serpentine woodland cell in the Oregon Natural Heritage Plan (Natural Heritage Advisory Council 1993).

- Investigate opportunities for the acquisition of habitat on private land to increase the amount of habitat in federal ownership.
- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Evaluate eligibility for ACEWRNA designation. Designate if eligible.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Monitor plants on public land to determine population trends,

3. Callahan Creek Population (three separate subpopulations)

A. Elk Creek Subpopulation

This subpopulation occurs on roughly 6 acres BLM, Forest Service, and private land. Portions of the subpopulation is located with in a power line right-of-way. Threats include herbivory, natural succession, and logging.

- Investigate opportunities for the acquisition of habitat on private land to increase the amount of habitat in federal ownership.
- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Coordinate with to mitigate impacts from pole, tower, and right-of-way maintenance.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Monitor plants on public land to determine population trends.

B. Drew Creek Subpopulation

This subpopulation occurs across approximately 800 acres of Forest Service and private land. Threats include herbivory, natural succession, logging, and grazing. Habitat satisfies the Douglas-fir, Jeffrey pine serpentine woodland cell in the Oregon Natural Heritage Plan (Natural Heritage Advisory Council 1993).

- Investigate the opportunities for the acquisition of habitat on private land to increase the amount of habitat in federal ownership.
- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Evaluate eligibility for ACEC/RNA designation. Designate if eligible.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Manage livestock grazing inside habit boundaries.
- Develop burn plan and prescribe burn habitat on public land every 10 to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.
- Monitor plants on public land to determine population trends and effects of management treatments.
- Conduct demographic studies.

C. Callahan Ridge Subpopulation

This subpopulation occurs on approximately 100 acres of Forest Service and private land. Threats include herbivory, natural succession, logging, and grazing.

- Investigate the opportunities for the acquisition of habitat on private land to increase the amount of habitat in federal ownership.
- Pursue voluntary protection by land owners through cooperative agreements or the Oregon Heritage Registry Program.
- Coordinate with PP&L to mitigate impacts from pole, tower, and right-of-way maintenance.
- Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.
- Manage livestock grazing inside habit boundaries.
- Develop burn plan and prescribe burn habitat on public land every to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.
- Develop habitat restoration plan and restore meadow habitat with native bunch grasses or other native species, as appropriate.
- Monitor plants on public land to determine population trends and effects of management treatments.

- **Conduct demographic studies.**

4. Sexton Mountain Population

This population is located on 10 acres of BLM land. Threats include herbivory, natural succession, logging, and mining.

- **Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.**
- **Develop burn plan and prescribe burn habitat on public land every 10 to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.**
- **Monitor plants on public land to determine population trends and effects of management treatments.**

5. Sprignet Butte Population

This population is located on five acres of BLM land. Threats include herbivory, natural succession, logging, and mining.

- **Collect seed for storage at Berry Botanic Garden Cryogenic Seed Bank.**
- **Develop burn plan and prescribe burn habitat on public land every 10 to 20 years and/or girdle trees, precommercial thin, and commercial thin to produce gaps in forest habitat and maintain meadow habitat.**
- **Monitor plants on public land to determine population trends and effects of management treatments.**
- **Conduct inventory of potential habitat.**

Monitoring

Monitoring is a key component of this conservation strategy. It will be necessary to determine the effectiveness of the proposed management actions and whether the management objective of the conservation strategy is being achieved. Proposed management actions are intended to be flexible. As monitoring data are collected management actions will be modified and the conservation strategy amended, as necessary, to ensure that the management objective is achieved. Amendments will be implemented only with full consent of the signatures of this plan.

Two types of monitoring are proposed, ecological status monitoring and management treatment monitoring. The purpose of ecological status monitoring is to determine trend by tracking the numbers of individuals in populations and subpopulations over time. Management treatment monitoring is intended to evaluate the response of populations and subpopulations to selected management treatments.

Ecological Status Monitoring

Monitoring Objective. The objective for ecological status monitoring is to detect a 30% change in population or subpopulation numbers over a five year period with a 10% chance of a missed change error and a 10% chance of a false change error.

Monitoring Locations. Monitoring will be conducted annually on federally owned land at the following locations:

1. Ace Williams Mountain
2. North Myrtle Creek
3. Drew Creek
4. Callahan Ridge
5. Sexton Mountain
6. Sprignet Butte

Monitoring Methods. Ecological status monitoring will be conducted by BLM and Forest Service personnel, through challenge cost share or by contract.

Monitoring will be conducted according to the following procedures.

Stratify habitat into closed canopy forest and open canopy forest/meadow habitats if environmental conditions dictate a need to do so.

2. Randomly select plots within each stratum by griding habitat and randomly selecting coordinates. Begin with at least six plots per stratum.

3. Permanently mark plot corners in the field on one side (lengthwise) with rebar. Mark remaining corners with metal spikes. Approximate locations of each plot will be marked on aerial photos and permanently placed in the monitoring file.

The length and width of plots will be determined by habitat conditions. The length of each plot should be approximately twice as long as the average distance between plant clusters, The width of the plot should be no less than 1 meter and no greater than 5 meters.

The number of plots will be adjusted, as necessary, after preliminary sampling to achieve the statistical accuracy as stated in the monitoring objective.

4. When plants are in flower, count the number of vegetative and flowering plants and record on data form.

   Photograph plot from either end and record photo point on data form.

   Record canopy cover using a densiometer in the center of the plot.

   Record all vascular plant species located in each plot the first time data is collected from each plot.

   Recording environmental variables such as temperature and precipitation are optional. They may be measured on site or recorded from adjacent weather stations. If recorded they should be used to help interpret population fluctuations.

5. Use plot data to estimate total population or subpopulation numbers along with population standard deviations and confidence intervals (Appendix E).

   If numbers decrease more than 30% over a five year period, then the cause of the decrease will be identified and appropriate management actions recommended. Regression analysis should be used for data analysis.

Management Treatment Monitoring

Monitoring Objective. The objective for management treatment monitoring is to detect if there is a 30% change in the number of plants in control verses treated plots with a 10% chance of a missed change error and a 10% chance of a false change error. Treatments to be tested will be limited to burning and thinning.

Monitoring Locations. Sites identified in the previous section for burning and thinning are eligible for management treatment monitoring. These include:

1. Ace Williams Mountain
2. Jim Creek
3. Drew Creek
4. Sexton Mountain
5. Sprignet Butte

Monitoring Methods. Management treatment monitoring will be proposed as studies or research and accomplished through challenge cost share or contract with the National

Biological Survey, Pacific Northwest Forest and Range Experiment Station or other research organization as appropriate.

Monitoring will be conducted according to the following case study experimental design (i.e. results will not be applicable to other locations).

1. Stratify habitat into closed canopy forest and open canopy forest/meadow habitats if environmental conditions dictate a need to do so.

2. Establish a split block experimental design with at least three replications of in each stratum.

3. The subplot for each treatment should be of a size and shape so as to minimize variance within treatments. Consider using the same size and shape as that used for ecological status monitoring.

4. Count the number of vegetative and flowering plants in each subplot.

5. Use multi-factor analysis of variance to determine the effects of burning and thinning in each stratum on the number of flowering plants, the number of vegetative plants and the total number of plants. This experimental design is not intended to compare the difference between strata, only the treatments within each stratum.

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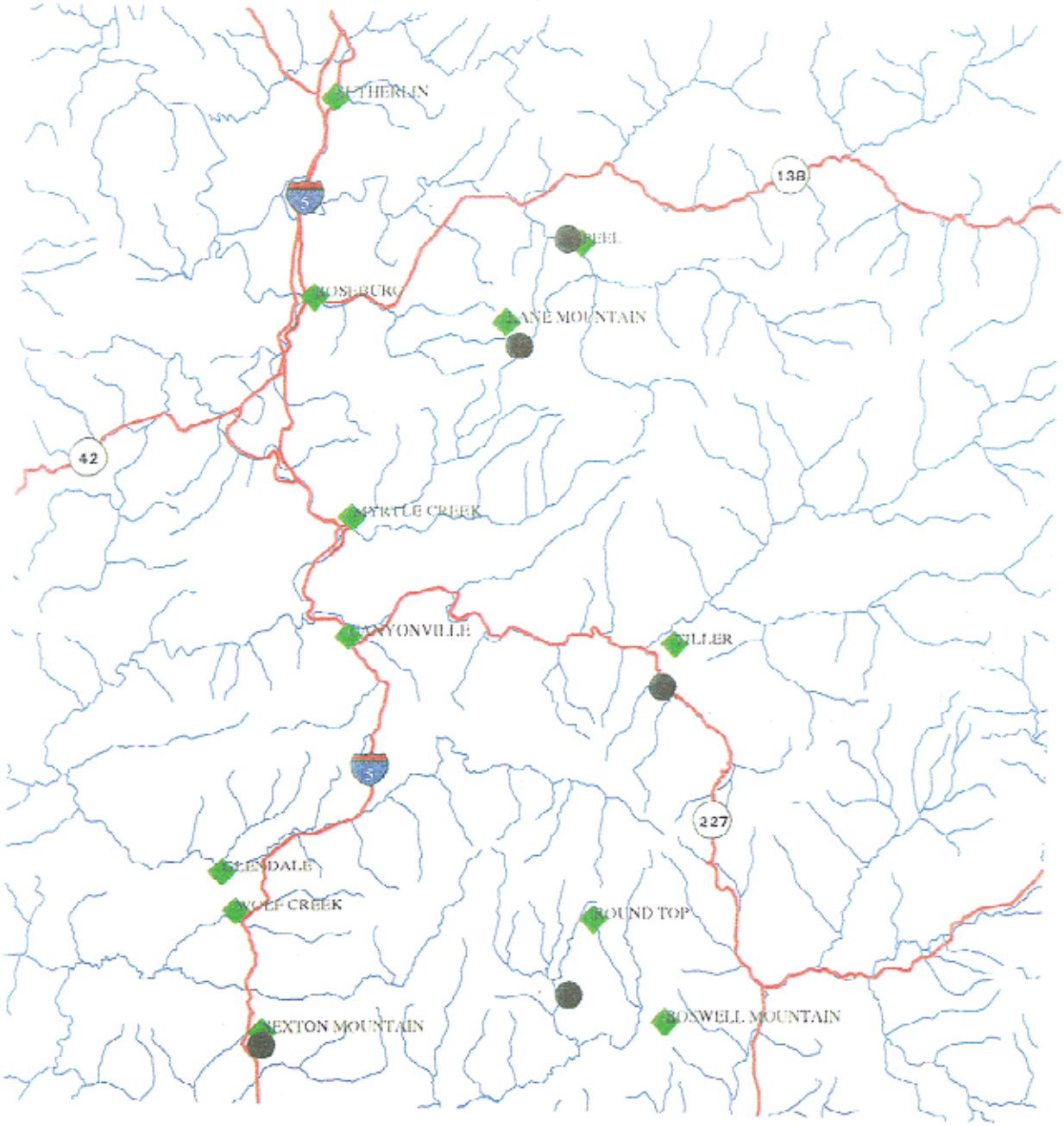
Appendix A
Range Map for *Calochortus umpquaensis*



● *C. umpquaensis* location

Appendix B
Associate Species

Scientific Name	Common Name
Acer circinatum	Vine Maple
Achilles millefolium	Common Yarrow
Aira caryophyllea	Silver Hairgrass
Arbutus menziesii	Pacific Madrone
Arctostaphylos viscida	Sticky Manzanita
Aspidotis densa	Podfern
Berberis aquifolium	Shining Oregongrape
Bromus carinatus	California Brome-grass
Bromus mollis	Soft Brome-grass
Bromus vulgaris	Columbia Brome-grass
Calocedrus decurrens	Incense Cedar
Calypso bulbosa	Fairy-Slipper
Camassia leichtlinii var. suksdorfii	Great Camas
Campanula prenanthoides	California Hairbell
Cardamine pulcherrima	Slender Toothwort
Ceanothus cuneatus	Buckbrush
Cerastium arvense	Field Chickweed
Collinsia grandiflora	Large-flowered Blue-eyed Mary
Collinsia rattanii	Rattan's Collinsia
Cryptantha intermedia	Common Cryptantha
Cynosurus echinatus	Hedgehog Dog's-tailed Grass
Danthonia californica	California Oatgrass
Delphinium menziesii	Menzies' Larkspur
Disporum smithii	Smith Fairy-bell
Dodecatheon hendersonii	Henderson's Shooting Star
Elymus glaucus	Western Rye-grass
Epilobium brachycarpum	Tall Annual Willow-herb
Epilobium minutum	Small-flowered Willow-herb
Eriophyllum lanatum	Wooly Sunflower
Erythronium oregonum	Giant Fawn-lily
Festuca californica	California Fescue
Festuca idahoensis	Idaho Fescue
Galium aparine	Goose-grass
Githopsis specularioides	Common Blue-cup
Goodyera oblongifolia	Western Rattlesnake-plantain
Hieracium albiflorum	White-flowered Hawkweed
Hieracium parryi	Parry's Hawkweed
Hypericum perforatum	Common St. John's-wort

Appendix B-continued

Koeleria cristata	Prairie Junegrass
Listera sp.	Twayblade
Lomatium macrocarpum	Large Fruited Lomatium
Lomatium nudicaule	Barestem Lomatium
Lonicera hispidula	California Honeysuckle
Lotus micranthus	Small-flowered Deervetch
Madia elegans	Showy Tar-weed
Madia exigua	Little Tarweed
Madia madioides	Woodland Tarweed
Melica subulata	Alaska Oniongrass
Mimulus guttatus	Yellow Monkey-flower
Minuartia cismontana	Cismontane Sandwort
Montia sibirica	Siberian Montia
Orthocarpus hispidus	Hairy Owl-clover
Perideridia oregana	Oregon Yampah
Phacelia capitata	Scorpionweed
Pinus jeff reyi	Jeffrey Pine
Plectritis congesta	Rosy Plectritis
Poa secunda	Pine Bluegrass
Polystichum munitum	Common Sword-fern
Pseudotsuga menziesii	Douglas-fir
Ranunculus occidentalis	Western Buttercup
Rhus diversiloba	Poison Oak
Rumex acetosella	Field Sorrel
Sedum radiatum ssp. ciliosum	Stonecrop
Sidalcea virgata	Rose Checker-mallow
Silene hookeri	Hooker's Silene
Sitanion jubatum	Big Squirreltail
Smilacina stellata	Starry False Solomon's Seal
Stipa lemmonii	Lemmon's Needlegrass
Synthyris reniformis	Snow-queen
Taxus brevifolia	Pacific Yew
Thlaspi montana var. montana	Mountain Pennycress
Trientalis latifolia	Western Stat-flower
Trifolium microcephalum	Small-head Clover
Trifolium tridentatum	Sand Clover
Trisetum canescens	Tall Trisetum
Viola hallii	Hall's Violet
Whipplea modesta	Whipplevine
Zygadenusvenenosus	Meadow Death-camas

Appendix C
Population Data Summary

Population/ Subpopulation	Ownership-1	No. of Plants-2	Habitat-3	Elevation (feet)	Acres
Ace Williams	BLM,PV	600,000+	ME	800-2000	250
Standley Road	PV	10,000	F,W	800-I 200	75
Jim Creek	BLM,PV	5,000	F,ME	1300-2000	25
Watson Mountain	PV	1,000	M	2000-2300	8
N. Myrtle Creek	BLM,PV	1,000	F,M,E	1600-2700	91
Elk Creek	BLM,FS,PV	130	F,M,E	1100-1300	6
Drew Creek	FS,PV	70,000	F,M,E	1500-2600	800
Callahan Ridge	FS,PV	5,000	F,M,E	2300-2700	100
Sexton Mountain	BLM	100	M	2400-2600	10
Sprignet Butte	BLM	100	F,E	2700-2900	5

1-Ownership: BLM= Bureau of Land Management, FS= Forest Service, PV= Private

2-No. of Plants: Upper values are displayed where sighting reports provide a range of values

3-Habitat F= Forest, M = Meadow, E= Ecotone

Appendix D
Implementation Schedule

Management Action	Population/1 Subpopulation	Lead-2 Program	Begin Date	End Date	Frequency	Cost-3
Acquisition	A,S,J,W,W,W	Bot,Lands	1996	2005		4WM+ $1 OOO/ac
Coop Agreements	A,S,J,W,NW,C	Bot	1996	2005		**1 WW/y**
ACEC Evaluation	W	Bot	1996	1998		2WM/y
PP&L Coordination	A,S,E	Bot, Lands	1996	2005		1/4WM/y
Seed Collection	A,S,J,W,W,W,W	Bot	1996	2005	Annual	1/4WM/ y
Gates & Fences	A,J	Bot	1997	1998		$2000
Grazing Management	A,J,W	Bot	1996	2005		$1000
Prescribe Burn	A,J,QW,B	FM	1997	2005	1O-20 yrs	$3OO/ac
Meadow Restoration	A,J,W	Bot,WL,Silv	1997	2005		$450/ac
Thinning	A,J,W,B	Silv	1996	2005		$7,000/ 20 ac unit
Ecological Mon.	A,E,D,C,X,B	Bot	1996	2005	Annual 2WM/y	
Mgmt Treatment Mon.	A,J,D,C,X,B	Bot	1997	2005		$10,000 per site
Inventory	B	Bot	1996	1998		$4/ac

1-PopulationlSubpopulation:
- A=Ace Williams Mountain
- S=Standley Road
- W=Watson Mountain
- J= Jim Creek
- N=North Myrtle Creek
- E=EIk Creek
- D=Drew Creek
- C=Callahan Ridge
- X=Sexton Mountain
- B=Sprignet Butte

2-Lead Program
- Bot= Botany
- WL=Wildlife
- Silv=Silviculture
- FM = Fire Management

3-Cost: Average Cost Per District

Appendix E
Statistical Calculations

Population Standard Deviation

$$S_{pop} = \sqrt{[(N^2)(S^2/n)(1 - n/N)]}$$

N = number of possible plots inside population boundary
n = number of actual plots
S^2 = variance between plots

Total Population Estimate

$$T_{pop} = (X)(N)$$

X = sample mean
N = number of possible plots inside population boundary

Confidence Interval (90%)

$$CI = (to.1\ 0(2),v)(S_{pop})$$

t = t distribution critical value
v = degrees of freedom (n-l)
S_{pop} = standard deviation for population

if $CI \leq (0.3)(T_{pop})$ you have met the monitoring objective of being able to detect a 30% change in population with a 90% confidence.